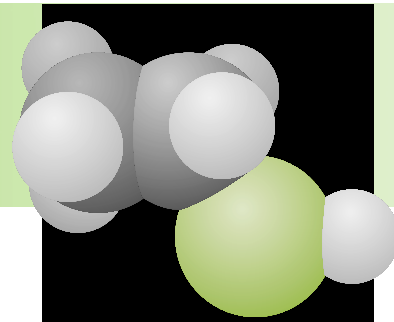


CHEMICALS

Project Fact Sheet



NANOFILTRATION OF SOLVENTS

BENEFITS

- Decreased energy consumption
- Lower capital costs
- Increased process efficiency and reduction in waste
- Reduced operating costs

APPLICATIONS

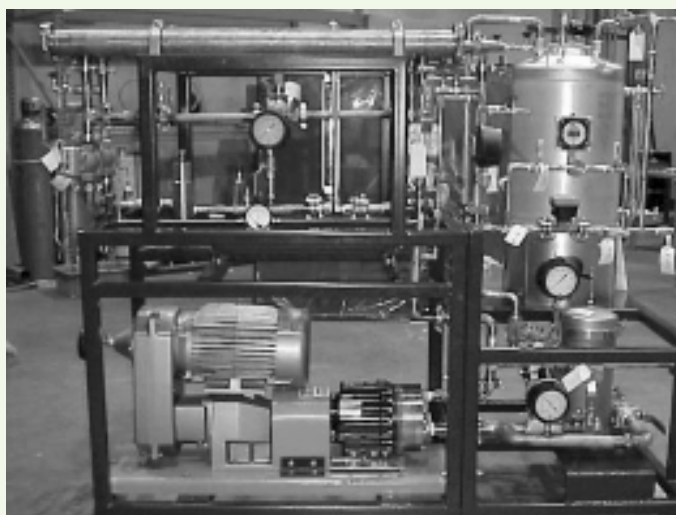
Initial solvent-resistant nanofiltration membrane applications include the separation of extraction solvents from food oils and the separation of light hydrocarbons and oil mixtures. In the long-term, nanofiltration membranes will continue to improve with lower molecular weight cut-offs and higher flux. These improvements will open this technology to new broad, energy-saving applications.

MEMBRANE MATERIAL ALLOWS HIGH FLUX AND RESISTS DEGRADATION BY ORGANIC SOLVENTS

Separation of organic mixtures by distillation accounts for nearly 3 percent of total U.S. energy consumption. Distillation processes often involve the separation of small solvent molecules from large oil molecules. Many of these separations could be performed at nearly half the energy costs and at lower capital costs by selective permeation through membranes. However, commercial membranes are adversely affected by organic solvents or exhibit permeation rates too low to be economical. To overcome current performance limitations, project partners are developing thin layer composite nanofiltration membranes using polyacetylene materials. These test membranes demonstrate good solvent resistance, high solvent permeation rates and consistent oil rejection in laboratory tests. Future project research will focus on developing a commercial nanofiltration module that has broad applications within industry.

Distillations used by refineries and crop-based industries to separate solvent/oil mixtures consume nearly 100 trillion Btu per year. Utilizing the membranes developed in this project could save substantial energy in certain refinery and crop-based oil distillations. The latter stages of research will focus on incorporating the polyacetylene membrane into spiral membrane modules. These modules will be characterized in lab and pilot tests to determine the best operating parameters. Commercial size modules will be built and field tested in one refinery and one crop-oil application.

NANOFILTRATION SYSTEM



The solvent nanofiltration test system used for project testing.



Project Description

Goal: The goal of this project is to fabricate membrane modules based on the composite nanofiltration membranes developed during the project's early stages. Project partners will demonstrate the technical and economic feasibility of these modules by: 1) using small diameter modules at laboratory and pilot scale to obtain process design data, and 2) using commercial scale modules in a field demonstration.

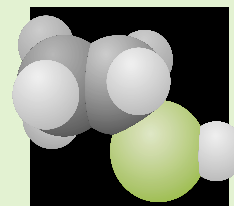
Progress and Milestones

In the initial stages of research, the performance characteristics of polyacetylene composite membranes were evaluated with a variety of organic solvents and solvent/oil mixtures. The fluxes of these membranes were shown to be an order of magnitude higher than those of the best commercially available membranes with similar rejections. The following are targeted milestones for future research:

- Scale-up to modules for laboratory tests
- Produce solvent-resistant, high-flux, thin layer composite nanofiltration membranes using production equipment
- Produce solvent-resistant membrane modules
- Conduct membrane and membrane module parametric studies
- Evaluate the performance characteristics of these membrane modules for optimal flux and rejection in refinery, crop-oil and other applications
- Compare with other commercial membranes by testing membrane modules at the University of Illinois Agricultural Bioprocess Laboratory
- Perform parametric field testing of modules at a commercial crop-oil facility to obtain practical process design data
- Develop a reliable computer process simulation to design single and multi-stage commercial nanofiltration systems that can also account for osmotic pressure changes
- Perform technical and economic analysis on industrial applications for these new membranes

Commercialization

The project partners will share in the commercialization and marketing of the technologies that result from this research. PSI Processing Systems will have exclusive marketing rights to developed novel membranes as they relate to solvent extraction processes from grain. Membrane Technology and Research will focus on commercializing these membranes for other applications.



PROJECT PARTNERS

Membrane Technology and Research
Menlo Park, CA

PSI Processing Systems
Memphis, TN

Chevron Company
Richmond, CA

University of Illinois
Urbana-Champaign, IL

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Charlie Russomanno
Office of Industrial Technology
Phone: (202) 586-7543
Fax: (202) 586-1658
charles.russomanno@ee.doe.gov

Please send any comments, questions,
or suggestions to
webmaster.oit@ee.doe.gov

Visit our website at
<http://www.oit.doe.gov/chemicals>

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585



July 2001